DIW Diskussionspapiere
Discussion Papers

Discussion Paper No. 149

The Computer Software Industry in East and West: Do Eastern European Countries Need a Specific Science and Technology Policy ?

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Berlin, May 1997

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Abstract

National science and technology (S&T) systems are often mentioned as a condition for competitiveness of high technology sectors. Therefore, public S&T policies should actively support the development of national S&T systems. In particular in Eastern Europe an active S&T policy is often demanded to support the development of the supposed domestic "high technology potential". This paper shows that this hypothesis is ill-founded in the case of the software sector. With an industrial economic analysis of the software sector it is shown, that a S&T policy is widely not able to fulfil this expectation. The analysis of the different market segments: standard and individual software, shows that the competition is carried out on axes which can widely not be influenced by a S&T policy. The links between software enterprises and the S&T systems are very weak, which is the result of the conditions of software development and the competition axes used in the software industry. Therefore, only few, and very general, starting points remain for an active S&T policy. Main starting points are: the improvement of the education in modern software technology, improvement of patent protecting laws and their enforcement, and introduction of standardisation procedures and quality standards.

JEL-classification: P51, L63, L11

Zusammenfassung

Nationale Innovationssysteme werden häufig als Voraussetzung für die Wettbewerbsfähigkeit von Hochtechnologiebranchen angesehen. Für Regierungen besitzt eine aktive Innovationspolitik einen hohen Stellenwert. Besonders in Osteuropa wird oft eine aktive Innovationspolitik gefordert, um die Entwicklung des vermuteten Hochtechnologiepotentials zu unterstützen. Dieses Papier zeigt, daß diese Hypothese für die Softwarebranche nicht gehalten werden kann. Mit Hilfe einer industrieökonomischen Analyse der Softwarebranche wird gezeigt, daß eine Innovationspolitik die in sie gesetzten Erwartungen weitestgehend nicht erfüllen kann. Die Analyse der Marktsegmente Standard- und Individualsoftware zeigt, daß der Wettbewerb auf Achsen stattfindet, die von einer Innovationspolitik weitestgehend nicht beeinflußt werden können. Als Ergebnis der Art und Weise wie Software entwickelt wird und der verwendeten Wettbewerbsachsen sind die Verbindungen zwischen den Softwareunternehmen und dem Innovationssystem schwach. Für eine aktive Innovationspolitik verbleiben daher nur wenige Ansatzpunkte. Als Hauptansatzpunkte werden eine Verbesserung der Ausbildung mit moderner Softwaretechnologie, eine Verbesserung des Patentschutzrechtes und seiner Durchsetzung sowie die Einführung von Stadardisierungsprozeduren und Qualitätsstandards identifiziert.

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1. Introduction

The software sector plays an important role in every modern economy because software is nearly omnipresent. In modern economies everybody uses software several times a day. The fields of application reach from a radio alarm-clock to an automated production process. Software is the instruction codes which make electronic components run. Software is what makes a microwave oven run, monitors the fuel injection in a car, or it is a word processing program.

This paper is only concerned with computer software and not the software embedded in electronic systems because a market does not exist for this. The software needed in these electronic systems is mostly developed in-house by the producers of electronic products. There are two reasons for this. The first is that they do not want to give out the required knowledge from their own enterprise. The second reason is the high cost of knowledge transfer which would be needed. So the make or buy question is mostly answered with in-house development.

This is completely different in the market for computer software. When IBM started to sell computer hardware and software separately in 1969, the computer software market was created. Since this time this market and the computer related service market have grown rapidly. Even in the '90s the market for computer software is still growing with two-digit rates in western countries. In post-socialist countries, due to the backlog demand, the growth rates are much higher. The majority part of in-house development of software is not captured in this estimations, because the enterprises mostly did not reveal this software development separately.[2]

So what is the reason for such continual high growth rates of the market for computer software even in depression times? The answer can be found in the fields of application for computer software. Computer software is applicable where automationable or rationalisationable processes are found and this is true for most parts of the economy. Automation and rationalisation in western countries has been reinforced in recent years. With this development the significance and sales of computer software sector also grow, even in

[2] Gerhardt (1992), p. 40-62.

depression times. But in recent years a saturation of the markets for computer software has been found in western countries. In CEE and CIS countries, the level of automation is still low and this means that the software sector in those countries will grow quickly over the next few years.

The topic of this paper is the examination of the competition on software markets and the consequences, which arise from this, for enterprises in CEE and CIS countries. In the second chapter the particularities of software production will be discussed and the linkages to the science and technology system (S&T system) will be analysed. The competition axes of different market segments will be examined in the third chapter. For each segment, a comparison of the different competition types and the strategies used by the enterprises will be worked out. The situation in those segments on the international software market is also described in this chapter.
Chapter 4 handles the prospects on domestic and international software markets for the software enterprises of CEE and CIS countries. In chapter 5 a preliminary evaluation of the situation of the software sector in post-socialist countries will be given. A discussion about the possibilities of a S&T policy to advance enterprises restructuring in the software sector finishes this paper.

2. Peculiarities of software creation

2.1. Development and production of software

For a better understanding of the software market, the peculiarities of software creation are to be examined in this part of the paper. A software program consists of instruction commands which make a computer run. The result of the creation process is a disk on which this instruction commands are saved. The creation process can be divided into a development phase and a production phase. The production phase, where the software program is reproduced on diskettes or other devices, comes closest to the „normal“ understanding of a production process. But the main emphasis of the creation process lies in on the development phase. The reason for this is the peculiarity that a computer program can be copied without a

loss of quality which is normally an important task of the production process. Furthermore the amount of material used in the reproduction process is very little. The following the term "software development", will be used instead of "software production" as it describes the origin process better.[3]

The development of software is a very labour intensive process whereas the capital intensity is low. Therefore software development is a fixed cost business in which variable costs are virtually zero.[4] To lower the costs of software development a lot of enterprises nowadays try to improve their productivity through total quality management (TQM) which is, so far, not as established as in the manufacturing industry. The introduction of TQM helps to lower the development costs enormously because the costs of removing mistakes increase exponentially with the duration of the development process. TQM also helps to notice wrong developments and it guarantees the fulfilment of expectations and requirements of the customers. This is important, especially in projects of high complexity, because the development costs are a function of the complexity of the software.[5]

2.2. Software as a product or as a service

A closer analysis of the development process of software shows that two completely different types can be identified. Corresponding to the plan of the enterprises, if the software program is to be sold to only one customer or if it is to be sold manifold to several customers, we can distinguish between the development of individual or standard software.

The development of individual software can be characterised by means of its service character. This development is characterised by individual, customer and order-oriented, single-unit production. The software is developed in a single project and can only be reused to a limited extent for other projects. The developed individual software is very heterogeneous, corresponding to the character of a service. An important influence in the development process is the basic condition. So the individual wishes of a customer can take part in this development process. Because of the project character of the development process, the risk for

[3] Correa (1996), p. 172.
[4] Blackburn; Scudder; van Wassenhove (1996), p. 1-2.
[5] Frey (1994).

financing, wrong development and delayed completion lie with the customer.[6] The customer bears all the development costs because the software is a single unit production and can mostly be sold only once. Single unit production leads to high development costs because of the high fixed costs which are not shared among several customers. Because the individual software had to be developed from the beginning, it is not immediately available. For the development process of such individual software, a close connection between supplier and customer is needed. A distribution network does not exist because the software has to be developed in the proximity of the customer.

In the segment for standard software, the development of software is from the beginning directed to selling it several times. Potential customers have no influence on the development of the software which shows that standard software has product character in contrast to individual software. The condition of the development of standard software is that standardisation is possible. Potential customers must be able to solve the problems for which they want to buy the software in the same way. The risk of financing, wrong development and sale lie with the developing enterprise.[7] The costs are lower than in the case of individual software because the development costs are shared among several customers. An advantage of standard software is that it is immediately available, and the further development of the software, as well as the repairing of faults in the software in the next program generation, is guaranteed. Because of the high development costs and the advantages of standard software named above, the share of individual software is falling and that of standard software is rising. But with this development the importance of individual adaptation of standardised software is rising as well.[8] The supplier of standardised software often use the same distribution networks as the producers of computer hardware. So computer and software products can mostly be bought in the same store.

A deciding factor for the kind of development used is the degree of standardisation of the software. The degree of standardisation is a function of the users who can solve a problem with the same software.

[6] Baaken; Launen (1993), p. 5.
[7] Baaken; Launen (1993), p. 5.
[8] Deppe (1994), p. 52-57.

$$\frac{\text{users who can solve their tasks with the same software}}{\text{all users with tasks in the same application field}} \equiv \text{degree of standardisation}$$

Diagram 1: Degree of standardisation

With the growing number of users who can solve a problem with the same software, the degree of standardisation increases. Therefore the standardisation degree is influenced by the complexity of the application field but also by other factors, such as international standardisation (e.g. international accounting rules) or the strategy of the software producing enterprises (e.g. extension of the function of products) etc..

For example, most people need the same elements to solve the tasks of their daily correspondence. So the standardisation degree for software which offers solutions for such a job is very high. Right at the other end of this standardisation scale, individual software is located, which can only be used by one user. In the middle of this standardisation scale accounting software is located for example. It has to consider the finance of the country in which it is used. Therefore, it has a lower degree of standardisation, because only users in this country can use such software for their accounting and as a result the number of potential users is fixed. A rising user-orientation leads to a fall in the degree of standardisation.[9]

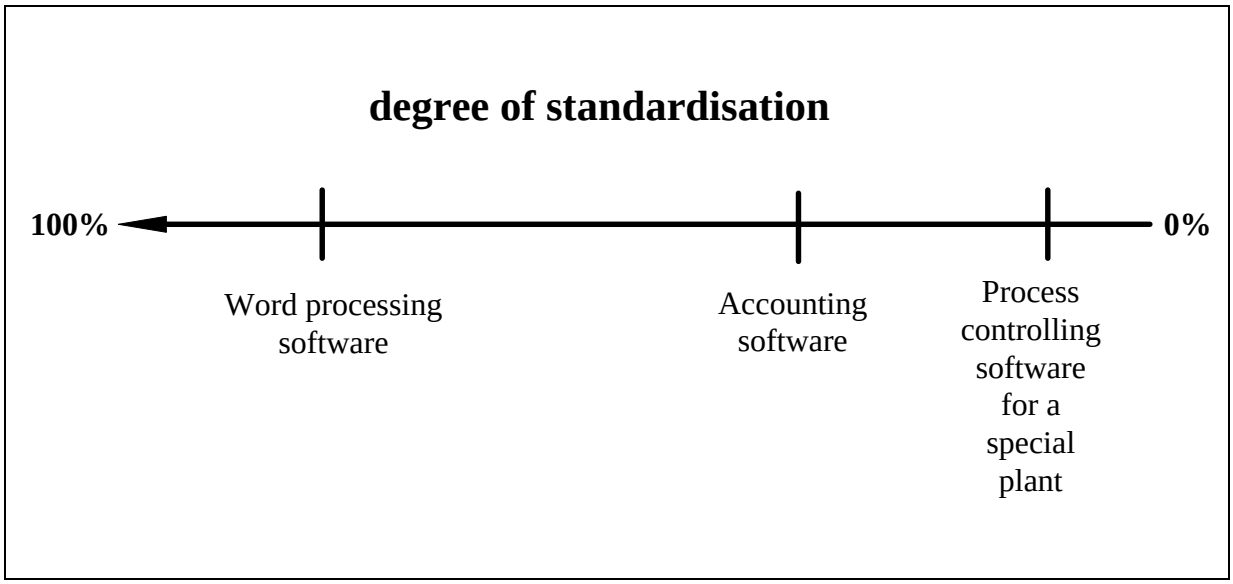

Diagram 2: Degree of standardisation of different kinds of software products

[9] Gerhardt (1992),p. 55.

2.3. Sources of innovation

The sources of innovation in the software sector are very special. The main source of innovation in the software sector is the internal R&D system. Enterprises in this market have a similar R&D system structure. Nearly all enterprises in the software sector operate only with their internal R&D system. In the case of individual software, the R&D system is located at every regional market on which the enterprises are present. In contrast to this market segment the developing enterprises of software products have home-based R&D systems, which is the result of the almost identical development of software products.[10] An external innovation procedure does not exist in either case.

Co-operation in development between software enterprises exists only between different segments; for example, operating systems and application software producers. But even such few attempts at co-operation between software enterprises fail (e. g. Microsoft and IBM). Even in those co-operation, the enterprises did not develop one product together, rather they each developed a component of their own (e. g. IBM develops the operating system OS/2 and Microsoft develops the application software Microsoft Office for this operating system). The reason for this can also be seen in the peculiarities of the software development. So if an enterprise were to outsource the development of software, the external partner would be able to reproduce this product for himself or with some modifications as a competition product. The problem here is the remaining knowledge of the external partner in terms of human capital, even if he must hand over all the development material. He would lose his striking competition advantage particularly in the case of proprietary hardware technology. With outsourcing, the software enterprise would produce a potential competitor because, for the creation of a competitive software product, only knowledge is needed and no other requirements hamper the production of a similar product. The normal procedure for getting access to required components, products or knowledge is to take over a corresponding enterprise. This lowers the risk of a potential competitor. Furthermore it lowers the costs and the time which is needed for in-house development. IBM for example buys Lotus because they need application software for their operating system OS/2.[11]

The external development of a component would furthermore cause enormous extra costs because the component has to be integrated in the complete software package. This is far more complicated than assembling a car from several parts produced externally.

[10] Baaken; Launen (1993), p. 11.
[11] Benedikter (1993).

On the other hand the increasing importance of strategic alliances can be observed. The aim of such alliances is to enforce an industry standard. An example of this is the X/Open Group which was founded in 1986 by ICL, Bull, Nixdorf, Olivetti and Siemens to enforce the UNIX operating system as an industry standard.[12] But after the EC-Commission decided that everybody must have access to the standards developed, several enterprises started to develop their own variants of the UNIX operating system. Today the following UNIX variants are used by the leading hardware enterprises:

Company	**Operating System**
DEC	ULTRIX
Hewlett Packard	HP-UNIX
IBM	AIX
Silicon Graphics	IRIX
Sun	Solaris
Siemens Nixdorf	Reliant UNIX

The linkages between software enterprises and universities differ between Europe and the United States. In Europe universities have two main tasks. Firstly they should educate software engineers, and secondly they should generate new basic and applied knowledge. But they do not participate in the development of new software products. Only a few, and unimportant links exist between industry and universities. In the United States, universities are more imbedded in the development of new software products. So a lot of enterprises have been founded by academics and a number of programming languages and software packages have resulted from interaction between industry and universities.[13]

3. The different segments of international software markets

If we say "computer software" we talk about a large number of very different computer programs. They differ in their construction principle, in their field of application, in their complexity and so on. For the examination of international software markets it is necessary to divide the different computer programs into different segments because the organisation,

[12] Glanz (1994), p. 384.
[13] Malerba; Torrisi (1996), p. 176-177.

strategy and distribution paths of enterprises as well as the competition differ greatly in such segments.

Basically, we will use the distinction of products and services: standardised software will be called “standard software“ despite individual elements (like named modules) and individual software will be limited to pure order production.[14]

The following table shows the value of the different software market segments in the EC. The market for computer software grows on average by 9% per year and lies far above the growth rates of the whole EC economy. In 1996 more money was spent on computer software (52,952 million ECU) than on computers (44,062 million ECU). This shows the importance of computer software in the computer industry. 55% of the computer software market was accounted by software products and the remaining 45% by individual software solutions.[15] The following tables show the development of the different segments of the computer software market in the years 1994-1998.

Value of the EC computer software market (Million ECU)					
Type of software	**1994**	**1995**	**1996**	**1997***	**1998***
- System software	12,051	13,047	14,134	15,414	16,821
- Application software	12,149	13,460	14,732	16,108	17,670
Software products**	24,200	26,507	28,866	31,522	34,491
Individual software	20,555	22,360	24,086	25,955	28,213
Computer Software	**44,755**	**48,867**	**52,952**	**57,477**	**62,704**

Shares of different kinds of software in the EC (in percent)					
Type of software	**1994**	**1995**	**1996**	**1997***	**1998***
- System software	27	27	27	27	27
- Application software	27	28	28	28	28
Software products**	54	54	55	55	55
Individual software	46	46	45	45	45
Total	**100**	**100**	**100**	**100**	**100**

* Estimated by EITO.
** Sum of system and application software.
Source: EITO 1997.

Diagram 3: The computer software market of the EC in figures

[14] Deppe (1994), p. 57.
[15] EITO (1997), p. 279.

The following graphic shows the distinction between the different segments of the computer software market.

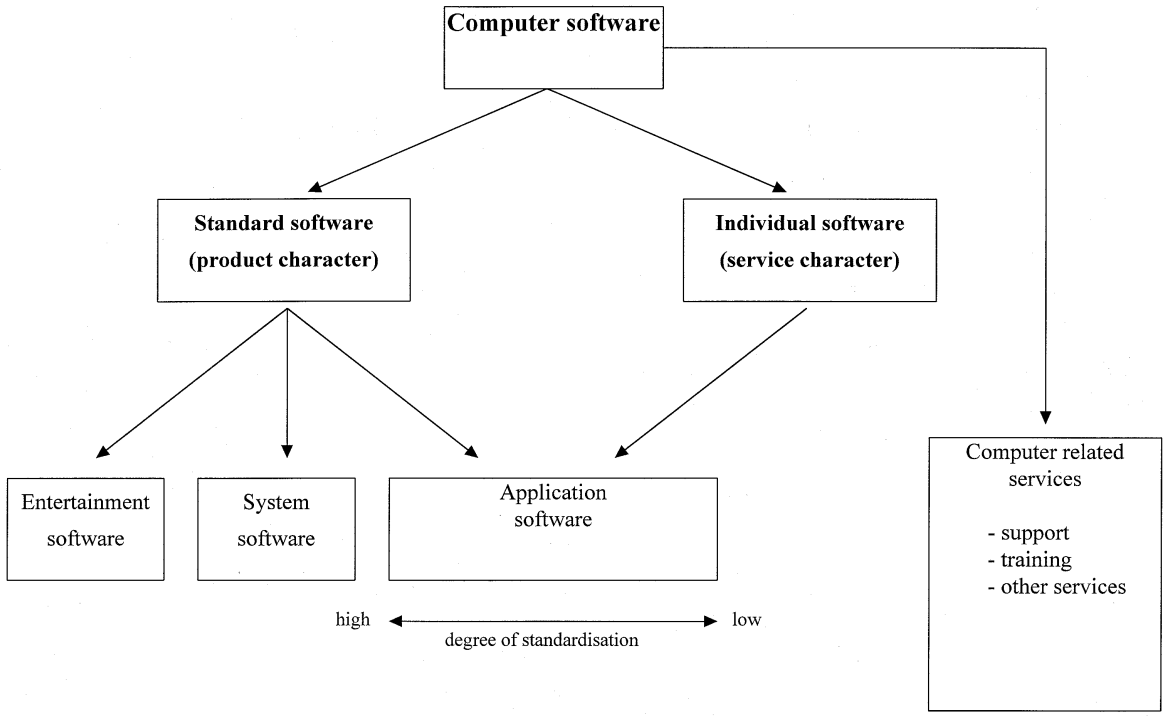

Diagram 4: Structure of the computer software market

3.1. The market segment for standard software

The market segment for standard software in the EC had a value of 28,866 million ECU in 1996 which corresponds to a share of 55% of the overall software market. This market segment can further be divided into several segments in which competition has different regularities. One can distinguish between hardware oriented (system programs) and user-oriented software (application software). A third segment should be added; entertainment software, which has special regularities.

3.1.1. Application software

The first segment of application software includes software programs, where development is oriented to the requirements of the users.[16] In this segment the development process is oriented to the solution of the user's problems. The OECD uses the definition that the concept of „application software" „covers all programs whose purpose is to solve the computer user's problems".[17] Examples of such problem oriented software are word processing programs, calculation software, presentation software, process controlling software, software for stock control, accounting software and so on.

The degree of standardisation of the software determines the strategy of the enterprise. The strategy of enterprises who offer products with a high degree of standardisation is different to that of enterprises which offer products with a low degree of standardisation. The reason for this is the difference between the markets on which the products are sold. Software products with a high degree of standardisation are mostly traded world-wide whereas products with a low standardisation degree are mostly sold nationally.

Competition between suppliers of standardised application software

With a rising degree of standardisation of software products, the possibility of selling them world-wide grows. Because of this, the number of potential competitors also grows. As a rule, the size of enterprises and the competition between them also rises with the standardisation degree of the software products. An interesting point is that the competition axes do not change between several degrees of standardisation.

Downstream competition:

In the market for standard application software, competition is held on five main axes:

- Quality
- Reputation
- Price

[16] The value of this market segment in the EC in 1996 was 14,732 million ECU which correspond to a market share of 49% of the standard software market.
[17] OECD (1985), p. 23.

- Compatibility
- Number of users

The quality of software is a very important competition factor because it finally determines possible loss of data. In times when software is used in almost all parts of an enterprise, the consequences are, in the best case some costs for the recovery of the data, and in the worst case the bankruptcy of the enterprise. This leads us directly to the second competition axis named above: the reputation of an enterprise. Without a tradition of some years and a high reputation, it is very difficult, almost impossible, to entice users away from a product of another enterprise. In this context the marketing strategy of an enterprise plays a very important role and should not be underestimated.
In the market for highly-standardised application software, network effects play an important role. Those network effects work between users who want to transfer their data. The more people who use the same software, the easier the transfer of data is, and with this the benefits for every user grow. It must be remarked that the suppliers try to prevent their competitors from developing a well functioning interface, with which it would be easy to transfer data between different software products and therefore disintegrate the network effects.

The high planning uncertainty that comes with the introduction of new software, leads to the increasing importance of the competition axes "compatibility of the software" and "existing number of uses". For enterprises who invest a lot of money in changing computer systems, the data compatibility between the software they use now, the new software and the future software generations is very important, because enterprises want to carry on using their collected data. A lack of compatibility causes high costs for the transformation of data into the required format. The proprietary technologies used in the workstation and higher computer platforms use this fact to bind their customers to their computer systems. Customers who are forced to buy software from their former supplier for compatibility reasons are called "locked-in-users".
On the other hand a large number of users guarantees that the future software standard in this application field must guarantee compatibility to be successful.
A large base of users is also a measurement of the existing human capital for such software. Nowadays it is not difficult to find personnel who know how to use Microsoft Word for Windows but to find advanced employees who know how to work with Word Perfect 5.1 will

be difficult.
At least, there is a direct linkage between the number of users and the price of the software product, because the development costs are distributed among the number of users.

If the potential customer can not decide on a software product with the help of the attributes named above, the price will be another orientation for him.

Upstream competition:

Upstream competition is held in only competition axes but they are crucial:

- Advanced skilled employees.
- Knowledge of system software.

The main competition axis is the human resource. Enterprises are in competition for the best and most experienced specialists on the labour market. As for other axes of upstream competition there is no shortage (e. g. all firms get financial resources for almost the same conditions). A second competition axis is knowledge about the interfaces to the system software because a correctly working program is only possible with good tuning between system software and application software. But often the suppliers of hardware use proprietary computer technology which hampers the software development of external enterprises. So only with their “permission“ do external enterprises get access to the required information about the computer technology. So in these segments, where proprietary computer technology dominates, hardware manufacturers play an important role in software development. With their special knowledge of their proprietary technology they have a striking competition advantage.

Status Quo on the global software market for standard application software

The global software market for standardised application software is characterised by an

increase in competition and concentration. Reasons for this are the high transparency of the market and the immense development costs. It is true that the number of potential competitors rises with the degree of standardisation, but with increasing competition a strong concentration on the market for highly standardised software has taken place in the last years. The situation is that the market for highly standardised software is dominated by a small number of enterprises e. g. Microsoft for office application software.[18] The position of the market leader in such segments is very strong due to the reasons described above (e. g. network effects). The high development expenditure of money and labour is the reason that only large sized enterprises are present on this market. The market segment for highly standardised application software is protected by high entry barriers. At first a potential competitor must be able to offer at least the same high quality of his products to be an alternative to the enterprises which are still on the market. To entice users away from their former supplier it would be further important to offer a lower price and a good reputation. But even with such near-perfect requirements it would take some years to capture a market share. So for a successful market entry large financial resources are needed in the market for highly standardised application software. A "hit and run"-strategy is therefore not possible in this market segment.

In market segments with a lower standardisation degree, the intensity of competition drops and with it the concentration. The market transparency is much lower than in the case of highly standardised software products. Such market segments are dominated by domestic enterprises, because they have competition advantages with regard to international companies. Such competition advantages are higher flexibility, a lower break even point in terms of customers, personal contacts, knowledge of language, mentality, culture, laws, national procedures and so on. With a loss of the standardisation degree, the number of small and medium enterprises on the market increases because their proximity to their customers, their flexibility and their lower break even point in terms of customers pay off.

The result of the investigation is that the market for standardised application software is nearly closed for highly standardised software while for low standardised software it is easier to enter the market and to set up a business.

[18] Other examples of leading software enterprises are: IBM, Oracle, SAP, Adabas, etc..

3.1.2. System software

The segment for standardised system software contains software programs which offer control, engineering control, translation or utility functions of the hardware.[19] They are the link between the hardware and the user and they make the use of a computer possible. The system software is a machine oriented software which is the requirement for the operation of data-processing systems and therefore the complete development process is oriented towards the attributes of the computer hardware. Examples of such programs are operating systems, programming tools, security utilities and so on.
Such system software has to guarantee that a data processing system will work properly. It controls the teamwork of the hardware components. In a simple case of a home PC this is „only" the CPU, memory, floppy disk, graphic device, hard disk and maybe a printer. But this can also mean the teamwork of several computers and a large number of industrial robots in a production process. The degree of complexity of system software is high, and so are the costs of development of such software. Incorrect system software will possibly cause a loss of data, unauthorised access to data, or the crash of a production process. The consequences for an enterprise are clear. This shows the requirement for high quality of such system software.

In this segment hardware producers play the dominant role because they have the necessary knowledge of the hardware. Almost all system software is developed by hardware producers themselves. Only Microsoft was able to successfully introduce an operating system without being a hardware producer.[20] Experts believe that this was only possible with the support of IBM in the early years, which named MS-DOS as their operating system for their PCs. Now MS-DOS (today Windows95) is an industry standard and the PC platform an open system. In the other computer classes such a development is hampered by the proprietary architecture of the computers. As the level of the operating system is left the importance of hardware producers drops because the software loses its system orientation. Because of the special knowledge and the necessary high quality, the number of suppliers in the market for system software is small. The system software is mostly developed for a special computer platform

[19] The value of this market segment in the EC in 1996 was 14,134 million ECU which corresponds to a market share of 51% of the standard software market.
[20] Another attempt was made by Novell with Novell Dos 7.0 which failed.

because their instructions use the hardware directly. Only some are created to deal with different systems e. g. some variants of UNIX, Windows NT. With the high rate of sales of equal computer generations, system software becomes a highly standardised software product. The growing number of users helps to share the high development costs and the price falls. In particular the sale of operating systems and attendance software are positively correlated to the sales figures of computers, because without such an operating system a computer will not work. Network effects play a more minor role than in the market for application software, because no data is accumulated with this kind of software. They only have indirect effects on the available application software for system software. If no application software is available for good operating system software, the establishment of such an operating system will be difficult. An example of this is the operating system OS/2 from IBM for PCs which was not able to guarantee that Microsoft's office package would work properly. This was enforced by Microsoft through a large number of updates free of charge so that IBM did not have the chance to fix the problems. Microsoft carried out this strategy for more than a year until they introduced their own operating system Windows95, which was of no better quality than OS/2. This shows a particularity of the market for operating systems in the PC market which is often described as an „chicken-egg“ problem: Without application software available, no user will buy the operating system. But without users, no one will program any software for such a system.[21]

Competition between suppliers of standardised system software

Because of the reasons described above, the competition axes differ from those in the application software market.

Downstream competition:

Downstream competition mainly takes place in the following three competition axes:

- Quality
- Reputation

[21] The Economist (1996), p. 5.

- Available application software

As analysed above, the quality is the crucial competition factor in the market segment for system software. If the quality does not guarantee the proper working of a data processing system, no one will buy such a software program because the risk of possible economic loss is too high. In this context, the term „quality“ also contains the aspect of optimal use of the hardware resources. This is particularly the case in the segment for programming tools. The great importance of quality in this segment leads us to the reputation of an enterprise. A good reputation of enterprises is the condition for their business in this market of system software. A good reputation means that an enterprise has experience in programming, installing and maintenance of computer systems. This holds especially for mainframes and large computer networks, where the standardisation degree is lower and a proper working of such systems depends on the fine tuning of the several components. Such programming and installation depends to a large extent on experience. For this a good reputation can not be compensated for by marketing activities.
In the segment where the customer wants to use highly standardised application products, the amount of available application software becomes a competition factor. So system software enterprises often enter into a contract with application software enterprises to guarantee that application programs will be available for their system software. IBM for example buys Lotus Smart Suite to guarantee application software for their operating system OS/2 after the co-operation between IBM and Microsoft ended. Microsoft ensures that SAP develop a variant of their R/3 program which runs under Windows NT.[22] In the workstation, mini- and mainframe and supercomputer market the computer manufacturer offer from the beginning a large range of software products for their proprietary computer technology as well as tested software products from external software producers like Oracle, Adabas, SAP etc..
The price plays a secondary role as a competition axis because of the dominant role of quality as a competition factor.

Upstream competition:

Upstream competition is held in only two competition axes which are existential:

[22] O. V. (1993b), p. 8.

- Advanced skilled employees.
- Hardware knowledge.

The main competition axis is the human resources. Enterprises are in competition for the best and most experienced specialists on the labour market. For other upstream competition axes there are no shortages. Only in the case where the developer of the operating system and the hardware manufacturer are not the same, does the access to the required knowledge about hardware technology become an important competition axis (e.g. Intel and Microsoft).

Status Quo on the global software market for standard system software

The market for system software is dominated by a small number of enterprises. This is not astonishing when one contemplates the conditions which are needed to be successful in this market segment. As a rule, with increasing computer size the importance of hardware producers in the system software segment increases too. The reason for this is the knowledge of hardware technology, which is needed to put an enterprise in a position to develop system software. Another reason is the long accumulated knowledge of the enterprises in this field which is a large competition advantage to potential newcomers. As described above, it is not possible to compensate for this with an increase of marketing activity.

3.1.3. Entertainment software

A small but steadily growing segment of the computer software market is the market for entertainment software.[23] The entertainment software segment has its own rules. The term „entertainment software“ covers programs like computer games, multimedia CD-ROM programs, reference work programs and so on. The customers of enterprises in this market segment are private households. Particularly in western countries the demand of the private sector is growing. More and more private households own computers and the younger generations are becoming an important customer group for this market segment. The products are highly standardised, so that they can be sold often. Particularities of this market segment are: no network effects or compatibility guarantees, no market leader and nearly no saturation exist.

Because no data is accumulated, network effects or compatibility guarantees are of no importance in the market for entertainment software. Furthermore the importance of a proper working of the software is not existential. Quality has another meaning in this market segment. With this the main arguments for the need of good reputation in the market segments for application, system and individual software vanish. Nevertheless, quality is an important competition factor between enterprises in this market segment. Quality here means the

[23] The value of this market was not available because it is statistically attached to the toy industry.

„increase of fun“. For example: improved graphics or sound design is a rise in quality. Competition is nevertheless low because the numerous products are not substitutes for each other. Every game has its own idea or history. With every new game developed the fight for customers starts at zero. Only some enterprises have been able to establish a continuation of games (e. g. Larry saga there are 8 parts up to now).

Another important competition axis is the knowledge of customers preferences at different times, and for this to be on the market at the right time with the corresponding computer game. For example, some years ago flight simulations where very popular; today simulations of the development of societies are popular. So the development of the market for entertainment software follows, like the fashion market, the taste of the customers and therefore the "normal" competition instruments have no importance in this market segment.

Another interesting point is that in contrast to the application and system software there is currently no saturation.

In this segment small and medium enterprises have good chances because market barriers do not exist. A hit and run strategy works in this market segment, because continuity is not needed. An important factor for the growth rates in this market segment are the computers installed in private households. But this shows that the potential markets for such products are the industrialised western countries.

3.2. The market segment for individual software

With a rising specificity and complexity of the requirements of the user, the range of available standard software decreases, as does the likelihood that an appropriate solution exists and can be adapted. In a lot of cases, enterprises need a software solution for special problems in their firm. So suppliers in this market segment offer the service of programming individual solutions for their customers. The development of individual software is organised in projects and oriented towards the needs of only one customer. Because such programs are closely connected to the organisation, the sector, the products etc. of the customer, standardisation -as in the case of standard application software - is not possible.

Because of high development costs and high costs of purchasing of the software development, enterprises only choose the development of made-to-measure software in cases where

standard software can't solve a problem. But with rising specificity and complexity of the requirement, the number of available standard software solutions drops; respectively, the likelihood that a existing solution is transferable decreases. Consequently the problems which are to be solved with the help of individual software are mostly very complex and specific. Furthermore, it should be added, that the offer of software products also differs with the computer class. So there are not as many software programs available for a mainframe computer as for a PC.
The main customers of such individual software are banks, insurance enterprises, enterprises of the manufacturing sector and state administrations.

Competition between suppliers of individual software

Downstream competition:

In the market for individual software competition is mainly carried out on the following competition axes:

- Quality
- Possibility of offering a complete solution (only for large projects)
- Reputation of the enterprise
- Personal contacts

Due to the high amount of planning uncertainty due to the quality, the compatibility and so on, the deciding factor of competition in this segment is the quality. With the decision for individual software the demanding enterprise enters a risk. The customer must bear the whole costs of development without knowing the result of his order. For this he bears the risk of the financing, wrong development and delayed completion of the software. Furthermore the customer is bound to the supplier enterprise for years, because of the high purchase costs and the mostly proprietary technology used. In terms of maintenance, support, further development and the possibly required supplementing of the software, the customers are bound to the suppliers because of the proprietary software technology used. The high purchase costs hamper the quick change of suppliers before the amortisation.

In the case of individual software, the quality aspect contains more then just the proper working of the software. In particular the fulfilment of the expectations and requirements of the customers as well as the control of the project schedule and the project budget are an important part of the quality in the individual software market. To guarantee this quality, more and more software enterprises are introducing total quality management (TQM). This should help to prevent the overrunning of the project schedule and the project budget. The requirement of money and time to correct a mistake grows exponentially with the duration of the development process. TQM requires close co-ordination of the development process between the suppliers and their customers. For this enterprises have to build up an R&D system at every regional market in which they want to be present. Knowledge of the language, the mentality, the culture, the laws, the national procedures and so on are a very important factor referring to the quality competition in this market segment.

The customers often only know their problems, which they want to solve with the help of software and have no idea about possible software realisation. The service of software enterprises often has to contain a requirement analysis therefore, in which the problems of the customers are analysed. This means that offering an optimal solution which guarantees the fulfilment of the expectations and requirements of the customers, requires an analysis of the field of application of the customer (e.g. process organisation, procedures etc.). This is the reason why management consultancies often also offer a programming service because they have good possibilities for the analysis requirement. An example of this is the Arthur Andersen & Co. management consultancy, which is one of the biggest supplier of programming services in the USA.[24]

In large projects, the trend goes towards complete solutions where the hardware and software is installed by one enterprise. The reason for this is the maintenance of the computer system. Experience shows that if the system components are installed by two or more enterprises, the enterprises always name the other partner as responsible for any faults which appear. With the complete project in one hand, the customers have a better position against their suppliers. So large enterprises which have the capacities and the capabilities, offer the installation of a complete data processing system including the hardware and software.

Because of the high costs of purchasing a new individual software, customers want to

[24] Siwek, Furchtgott-Roth (1993), p. 21.

minimise the risk of such a decision while they try to estimate the solidity of an enterprise. The customers mostly measure the reputation of enterprises by their age and their size. Age and size are taken as indicators for the solidity of software enterprises. In this decision process, a personal contact can be a competition advantage compared to other competitors.

For an urgently needed individual solution the price is of lower importance. Nevertheless its importance increasing because the large international enterprises are able to offer similar services to the customers. Therefore the price is becoming a more and more important competition axis in the market segment for large projects.

Upstream competition:

In upstream competition the main competition axis is, as in all parts of software sectors, human capital. Advanced and skilled employees are the most important input factor in the sector for individual software.

Status Quo on the global software market for individual software

When projects of high complexity and large size are traded, large international enterprises dominate the market. This is the case when state administrations, large insurance companies or banks are searching for complete solutions. In this case only large enterprises have the capacity and capability to handle such projects. The disadvantages compared with domestic enterprises are generally low because such customers act according to international procedures. For example concerns like Daimler Benz use an international accounting system because they are also present at international stock exchanges. The number of potential suppliers diminishes with the capacities required to handle such projects. So this market segment is also dominated by large international software enterprises and system houses which also can offer hardware solutions.

With a fall in the size and complexity of software projects and, with it, of entry barriers, the competitiveness of small and medium domestic enterprises rises. Such market segments are

dominated by domestic enterprises, because they have competition advantages in comparison to international companies. Such competition advantages are higher flexibility, lower costs, personal contacts, knowledge of language, mentality, culture, laws, national procedures and so on. The proximity of the software enterprises to their customers, their flexibility and their lower costs pay off.

4. Prospects for software enterprises from Eastern European Countries

In current literature it is often mentioned that the software enterprises of CEE and CIS countries have "glorious" times ahead of them and that they will play an important role in the global software market of the future. Such an appraisal results from the assumption that the removal of the hardware shortage and the access to international knowledge will release the potential of their programmers. But this does not take into account the fact that with this opening of the domestic markets, the basic conditions of the software business change fundamentally. The competition axes, the competitors, the quality and the application fields of the demanded software, the required human capital and some other internal factors have changed and served as entry barriers for the new software enterprises.

With the entry of international software enterprises, with their experience and their immense financial resources, the quality of competitors of domestic software enterprises changes fundamentally. And this is not only the case in downstream competition but also in upstream competition in terms of qualified personnel, where foreign enterprises have the ability to pay much higher wages than domestic enterprises.

Another important basic condition which is changing, is the knowledge required to be successful on the software market. The demands on a software enterprise expand from the „simple“ knowledge of how to program software to the knowledge that is needed by the customers. A detailed knowledge of the application fields in which the software developed is applied is essential. But with the introduction of economic constraints, the organisation, strategies, technologies etc. of the demanding enterprises have changed. The software developing enterprises must acquire knowledge about such a changed situation because now

every competitor has the ability to program, and a very important competition factor on the software market is the ability to fulfil the requirements of the customers.

Some internal factors of the CEE and CIS countries must be added to these arguments. Firstly there is the small size of the software markets in CEE and CIS countries.[25]
Such small markets are unable to provide a platform for the development of products of a certain complexity and cost by themselves. A second factor is the small size and the lack of financial resources of the domestic enterprises which is a competition disadvantage in comparison to the international enterprises particularly in the case of large projects.

A third internal factor is the lack of infrastructure which is needed for software development like standardisation procedures, telecommunications, patent protecting laws and their enforcement.[26] This lack hampers the development of the software sector and with it the development of the enterprises, because without the enforcement of patent protection, software enterprises are not paid for their products. This is in particular a great disadvantage for small and medium domestic enterprises.[27]

Another factor of growing importance in the trade in software is modern marketing instruments which enable enterprises to build up a good reputation.

So if we summarise the arguments named above, which are true for almost every segment of the software market, the conclusion is that this development leads to a strong devaluation of human capital in the software sector of CEE and CIS countries. Internal factors are also obvious obstacles for a rapid catching up of CEE and CIS countries in software technology. The software enterprises of CEE and CIS countries will start with an competition disadvantage in the future. A look at the market statistics in CEE and CIS countries prove this appraisal. In Hungary for example in 1992 ca. 85% of traded software was imported. And furthermore, 90% of this came of the USA. [28] For the other CEE and CIS countries the percentage is similar.

[25] For figures cf. chapter 5.
[26] Correa (1993b).
[27] Correa (1993a), p. 5-7 and Correa (1996), p. 173-174.
[28] Umann (1993).

For a closer analysis we will have a look at the different market segments distinguished above.

4.1. Standard application software

As described in the 3rd chapter, quality, reputation, compatibility, number of installations (or users) and the price are the main competition axes in the market segment for standardised application software. The quality of the software is a decisive factor for the customers. Because of the low experience in terms of installations, improvement and further development of standard software, the enterprises of CEE and CIS countries will find themselves in a difficult position against the western enterprises in their domestic market. Furthermore it must be taken into account that the demanders on the international market make heavier demands on quality of software. Therefore the internationalisation of products which were successful on the domestic market is no guarantee for a successful introduction on international markets. In this context, reputation also plays an important role. The big western enterprises are ahead in terms of international reputation. In the rapidly changing market situations in CEE and CIS countries this is a security factor because the customers can be sure that such enterprises will be present in the years to come. Because of support, training of personnel and maintenance of software, this is a decisive factor for the potential customers. On the international market eastern enterprises are generally completely unknown to the potential customers, which is a knockout criteria against them. The network effects which already exist, the compatibility requirements and the very low prices which are all the result of large user bases are very high entry barriers for Eastern European enterprises. This advantage can only be caught up in the medium or long term and with immense financial efforts which are generally not available in post-socialist countries. Marketing requirements in this segment are also very high. Technical capability is necessary but no guarantee of success. In particular, on the international markets marketing is an essential and costly component in the market segment for highly standardised application software.[29]

The chances for domestic software enterprises of setting up a business increases with the fall in the standardisation degree of the demanded software. In particular small and medium enterprises are potential customers for domestic software enterprises, because software plays

[29] Correa (1996), p.174 and Correa (1993a), p. 6.

no essential role in their business and therefore the quality is of lesser importance. A lower price and a good support is more important for them and the small domestic software enterprises are able, because of low labour costs and more flexibility, to offer cheap and well supported software products. An example of such application software is accounting programs. In this market segment domestic software enterprises have another competition advantage because of the still often-changing laws; these small enterprises have the flexibility to develop such small applications very quickly if a change in the law makes this necessary.[30]

The only really promising strategy for setting up a business in the international market for standard application software seems to be a niche strategy. Several software enterprise have been able to enter the international market with highly specialised applications. For example ParaGraph, a Russian software enterprise was a pioneer in the field of handwriting recognition technology. The enterprise was able to enter into co-operation with Apple Computer who want to apply this technology in their Newton-family notebook computers.[31] In every CEE and CIS country a handful of such success stories can be named and all of them use a niche strategy to enter the international market.[32] Whether such enterprises will be able to remain on the international market is an open question.

4.2. Standard system software

The market segment for operating systems is dominated by hardware and software enterprises like IBM, Unisys, Fujitsu, DEC, NCR, Bull, Sun, Apple and Wang. Even in CEE and CIS countries the western operating system programs were quickly adopted and are even available in national language. The operating systems for larger computers are only available in English all over the world, so that the English language is a required standard for system administrators. The access to the knowledge required for developing an operating system will be expensive or even not possible because the hardware producers want to commercialise their own operating system. This access is crucial for high quality and consequently the proper working of the computer system and this is the main competition factor in this market

[30] Umann (1993).
[31] Dyker (1996), p. 13.
[32] Dyker (1996) cf. for more examples.

segment. This domination offers no possibility of successfully entering this market segment for operating software.

The chances increase as we leave the level of operating systems. In the segments for controlling, security, maintenance and network software, the chances increase but are also bad for newcomers because of the lack of experience. Even Microsoft which tries to enter the market for network software has great problems in competing with Novell, the market leader in this segment because of Microsoft's immense lack of experience.

4.3. Entertainment software

The market segment for entertainment software offers the best chance for successfully entering the domestic and international software market. As described in chapter three, in this segment no network effects are present, the reputation of an enterprise plays no role. So entry barriers do not exist and the enterprises have the same competition conditions. The feeling for the taste of the customers is important in this market segment. This means developing the right game at the right time and with the right design (e.g. graphic design, sound design etc.). The Internet also enables small and medium enterprises in CEE and CIS countries to distribute their products across the whole world with low costs, which removes the last obstacle to the international market in this segment.

4.4. Individual software

The situation in the market for individual software is different. In this segment, new enterprises from CEE and CIS countries have a good starting position because they have competition advantages in comparison to foreign enterprises. In contrast to western enterprises they have no language problems, they know the mentality and the common procedures of the people, they can better estimate the needs of the customers and they have personal contacts. This particularly helps in the field where small and medium enterprises are the demanders of software. This is the case in the field for the adaptation of highly standardised software which is a rewarding business. Those enterprises offer installation, adaptation, support and training

of personnel for highly standardised products.

With the growing size and complexity of software projects domestic enterprises do not have the capacities and capabilities required to carry out such projects. The competition axes of quality and, with this, the reputation of the enterprise are getting more and more important. Foreign enterprises lower the competition advantages named above by establishing subsidiary companies with domestic staff or by entering into co-operation with a domestic enterprise. So if banks or state administrations need a software solution, international enterprises also appear as strong competitors.

5. The software sector in Eastern European Countries

5.1. The software sector in times of socialism and reforms

The progress of software development was mainly localised in industry and ministries. Application software was mainly developed for the needs of the military industrial complex, the institutions of central planning and scientific and technical computing. The military industrial complex, with it pervasiveness, prevented the extensive use of military R&D as a source of civilian software innovation. The penetration of industry by computer technology was low. So the focus of software development lies mainly on mathematical applications.
The lack of hardware was another obvious obstacle to software development in socialist countries. Because of the COCOM list the newest computer technology was not available in socialist countries. This was a particularly decisive factor in the field of supercomputing. Without a large amount of the required hardware, the development of modern software is not possible. The restricted openness of the socialist countries hampered the exchange of ideas between the software experts of east and west. With this lack of leading trends, information, and modern computer technology, the software industry produced software far below the level of western enterprises.[33] The population of experienced programmers remained small in socialist countries and the small number of programmers who had worked on large modern

[33] Burghart (1992), p. 131.

software systems resulted in a critical shortage.

The desire of the government policymakers to develop computer and software technology without high R&D costs and uncertainty led to the decision to catch up the backlog in the computer and software technology through imitation rather than through innovation.[34] Often western software products were bought, illegally copied and distributed at low costs.

Only in the 1980s did the situation change. The priority of information technology rose, due to the decision of the socialist parties, which identified information technology as a „future technology". With this decision the significance of the software sector rose as well.[35] But this change in the opinion of the policymakers was not well supported. Investment in terms of funding research and development, personnel training and equipment did not rise. As a result of this, the attempted catching up in computer and software technology did not succeed. So governments allowed other ways of enabling the supply of modern technology. Poland for example turned a blind eye to the shuttling of computers, computer components and software through tourists in the 1980s. This lead to an advantage for the Polish computer and software industry in post-socialist times, because access to knowledge in these times leads to a limited catch up in those technologies.[36]

The collapse of socialism and, with it, the lowering of trade barriers, led to an increase in trade and the entry of highly competitive, well organised and financed international vendors. The obsolete state-owned capacities where forced to either terminate operations or redirect their activity to software development and distribution, or information technology maintenance and data processing services, where domestic enterprises had a competition advantage.[37] So most capacities had to be built up from scratch or grow out of privatised state-owned data processing centres.[38] The markets of CEE and CIS countries were quickly penetrated by western software products. In the initial years after the collapse of socialism, western software companies sold their products through distributors or other trading partners. Some years later they opened own subsidiaries in each of the CEE and CIS countries.[39]

[34] Katkalo, Mowery (1996), p. 241-242.
[35] Cf. the changes in the Russian software industry throughout the Gorbachev period.
[36] Dyker (1996), p. 2.
[37] EITO (1993), p. 145.
[38] Kubilas (1996), p. 27.
[39] Examples: Microsoft Hungary (1992), Oracle Hungary (1993), Novell Hungary (1994), Budapest Business Journal (1997), p. 104-106.

5.2. Market situation in Eastern European countries 1996/97

Because of the great backlog of demand in the post-socialist economies the software sector is growing rapidly. Nevertheless the software markets in CEE and CIS countries are much smaller than in western countries. Furthermore, in all countries the software market is much smaller than the computer market. But the share of the software market is increasing.[40] Two main reasons for this development in Eastern Europe can be given: The first reason is that with a saturation of the first large backlog of demand, the conditions for a data processing system are present. But for an efficient computer system, efficient software is needed. So the importance shifts from hardware to software within a developing computer market. The second reason is that almost all CEE and CIS countries are introducing new patent-protecting laws, which should stop the wide-spread illegal copying of computer programs.[41] Particularly those countries in which western enterprises quickly built up production locations, like Poland, Czech Republic and Hungary, the software sector is getting more and more important. With the integration into the production network of western enterprises, the penetration of the industry rises and, with it, the demand for application software.

In the segments of highly standardised application software, the customers very quickly adopt the software standards of western countries. Now western products predominate and it appears that for the short and medium term eastern enterprises will not be able to successfully enter these already existing markets. For example, Microsoft introduced a Russian version of the MS-DOS operating system in 1990 which works on the IBM clones produced in the former socialist countries.[42] The great advantage was that for this operating system a large number of applications was already available. Today nearly all Microsoft products are available in the main native languages of Eastern Europe.

On the market for individual software or software with a low standardisation degree, domestic software enterprises are dominant. Particularly in the market segment where small and medium enterprises demand software products, domestic software enterprises have a large competition advantage, because of their knowledge of the situation in the country, their flexibility, their cost structure and their personal contacts.[43] In particular their knowledge of the situation in the countries and their flexibility are striking competition factors. Because of

[40] One reason for this is the high proportion of software piracy in the CEE and CIS countries.
[41] Experts estimate the share of illegally copied software in the CIS countries is 90%. Cf. vwd (1996), p. 5.
[42] Burghart (1992), p. 135.
[43] O. V. (1997), p. 15.

the often changing legislation, which enforces the adaptation of the software developed, large international enterprises are not able to compete with the small and medium software enterprises in Eastern Europe. Furthermore, business activities are mostly not standardised, as in western countries (e.g. through laws). So, for example, the accounting software differs from customer to customer, because no law enforces enterprises to do their accounting in a standardised way.

5.2.1. Poland

The software market of Poland had a value of 216 Million ECU in 1996 which corresponded to 0.4% of the European and 12% of the Spanish computer software market. Less than the 216 million ECU for software, 523 million ECU was spent on computers. With a percentage of 29% of the computer/software market, the share of the Polish software market is quite smaller than in western countries (about 50%). The share of standardised software, 53%, to individual software, 47%, corresponds to the distribution in the EC of 55% to 45%.[44]

Value of the Polish computer software market (Million ECU)					
Kind of software	**1994**	**1995**	**1996**	**1997***	**1998***
System software	43	47	54	62	70
Application software	36	45	61	74	86
Software products**	79	92	115	136	156
Individual software	63	67	101	114	150
Computer Software	**142**	**159**	**216**	**250**	**306**
Shares of different kinds of software in Poland (in percent)					
Kind of software	**1994**	**1995**	**1996**	**1997***	**1998***
System software	54	51	47	46	45
Application software	46	49	53	54	55
Total	**100**	**100**	**100**	**100**	**100**
Software products**	56	58	53	54	51
Individual software	44	42	47	46	49
Total	**100**	**100**	**100**	**100**	**100**

* Estimated by EITO.
** Sum of system and application software.
Source: EITO 1997.

Diagram 5: The computer software market in Poland

[44] EITO (1997), own calculations.

Particularly in company management and accounting software Polish enterprises are ahead of foreign software enterprises. In this segment of the software market with a low standardisation degree domestic enterprises are able to bring in their competition advantages of knowing the language, people, culture and daily proceedings, their low costs, high flexibility, as well as their personal contacts. Nevertheless, western vendors control the official software and service market. The predominance of the PC in the Polish computer market leads to the fact that the main activities in the Polish software market are sales and support of standard software, customised application development and networking, and hardware/software support services.[45]

Polish companies will in future go on to play an important role in the development of customised software and software with a low standardisation degree on the Polish market. But on international markets they lose their main competition advantages. So entering the international software market will be difficult.

5.2.2. Hungary

The Hungarian software market had a value 205 million ECU in 1996. This is 0.38% of the EC and 11.3% of the Spanish software market. The Hungarian software market is similar to the EC software market with a share of 46% of the computer/software market. The relationship between standardised software (48.3%) and individual software (51.7%) shows that individual solutions play an important role in the computer software industry.[46] Local software enterprises are largely involved in the development of individual software. Another reason for the relationship between individual and standard software, is large scale software piracy, because generally standardised software is illegally copied.

[45] EITO (1997), p. 62.
[46] EITO (1997), p. 240-316.

Value of the computer software market in Hungary (Million ECU)					
Kind of software	**1994**	**1995**	**1996**	**1997***	**1998***
System software	38	42	44	47	51
Application software	46	51	55	58	63
Software products**	84	93	99	105	114
Individual software	83	91	106	126	145
Computer Software	**167**	**184**	**205**	**231**	**259**
Shares of different kinds of software in Hungary (in percent)					
Kind of software	**1994**	**1995**	**1996**	**1997***	**1998***
System software	45	45	44	45	45
Application software	55	55	56	55	55
Total	**100**	**100**	**100**	**100**	**100**
Software products**	50	51	48	45	44
Individual software	50	49	52	55	56
Total	**100**	**100**	**100**	**100**	**100**

* Estimated by EITO.
** Sum of system and application software.
Source: EITO 1997.

Diagram 6: The computer software market in Hungary

In Hungary software enterprises are mainly export oriented. They focus especially on the large EC software market. Domestic software enterprises are well positioned because of the development of lowly standardised software like accounting software. The domestic software market is widely dominated by western enterprises and penetration by western products is therefore high.[47] To get an idea, in 1992 about 85% of the software traded in Hungary was imported.[48]

5.2.3. Czech Republic

The Czech software market had a value of 353 million ECU which corresponded to a share of 0.66% of the EC and 19.5% of the Spanish software market. The Czech software market was

[47] EITO (1997), p. 60-61.
[48] Umann (1993).

the largest in Eastern Europe in 1996, even larger than the Russian market. The share of the software market was 42% of the software/computer market.

Value of the computer software market in the Czech Republic (Million ECU)					
Kind of software	**1994**	**1995**	**1996**	**1997***	**1998***
System software	48	58	63	68	75
Application software	48	60	68	74	78
Software products**	96	118	131	142	153
Individual software	178	198	222	252	292
Computer Software	**274**	**316**	**353**	**394**	**445**
Shares of different kinds of software in the Czech Republic (in percent)					
Kind of software	**1994**	**1995**	**1996**	**1997***	**1998***
System software	50	49	48	48	49
Application software	50	51	52	52	51
Total	**100**	**100**	**100**	**100**	**100**
Software products**	35	37	37	36	34
Individual software	65	63	63	64	66
Total	**100**	**100**	**100**	**100**	**100**

* Estimated by EITO.
** Sum of system and application software.
Source: EITO 1997.

Diagram 7: The computer software market in the Czech Republic

On the software market individual software dominates in comparison to standardised software. The relationship is 63% individual to 37% standardised software, of the overall software market. The large difference could be the result of low penetration with standard software and/or software piracy. In the software market domestic enterprises compete successfully with international enterprises. Domestic enterprises are particularly active in system integration, individual software for PCs as well as for UNIX systems, standard software with a low standardisation degree and support and training. Nonetheless, western software enterprises control large parts of the software market. They are well positioned in highly standardised software, application tools, especially for relational database management systems, maintenance, support and individual software.[49]

The most solvent customers in the Czech Republic are banking and financial services,

[49] EITO (1994), p. 162.

government administration, insurance, industry and manufacturing, telecommunications, health services, transport and small private firms.[50]

5.2.4. Russia

The Russian software market had a value of 338 million ECU in 1996 which is 0.63% of the EC and 18.6% of the Spanish software market. The relationship between the expenditure on software and hardware differ extremely in Russia. So, the share of software expenditure is only 18.5% of the software/computer market.[51] As a reason for this situation the large dimension of software piracy and the large pool of local programmers is often named.[52] Experts estimate that about 90-98% of the software used in Russia is illegally copied.[53] In 1992 Russia introduced the "Law on Computer Program and Database Legal Protection" to establish a base for legal patent protection.

Value of the Russian computer software market (Million ECU)					
Kind of software	**1994**	**1995**	**1996**	**1997***	**1998***
System software	49	53	57	62	64
Application software	72	86	95	106	121
Software products**	121	139	152	168	185
Individual software	132	148	186	224	256
Computer Software	**253**	**287**	**338**	**392**	**441**
Shares of different kinds of software in Russia (in percent)					
Kind of software	**1994**	**1995**	**1996**	**1997***	**1998***
System software	40	38	38	37	35
Application software	60	62	63	63	65
Total	**100**	**100**	**100**	**100**	**100**
Software products**	48	48	45	43	42
Individual software	52	52	55	57	58
Total	**100**	**100**	**100**	**100**	**100**

* Estimated by EITO.
** Sum of system and application software.
Source: EITO 1997.

Diagram 8: The computer software market in Russia

[50] EITO (1997), p. 60.
[51] EITO (1997), p. 240-316.
[52] EITO (1994), p. 191.
[53] O. V. (1996), p. 5 and EITO (1994), p. 191.

Another reason for the low software expenditure could be the large pool of local programmers. Experts estimate that there are about 300,000 software programmers and engineers in the CIS countries. They offer individual software at low prices. For domestic enterprises this is a cheap alternative to the relatively expensive western products. Therefore penetration by western software products is low, because much of the utilised software is locally developed.[54] Also the relationship of system to application software 38%/62% shows that software programmed in Russia plays an important role on the domestic market.
Nevertheless western software enterprises announce record turnovers. So it remains to be seen, whether domestic enterprises could stand the increasing competition with international software enterprises.

5.3. Conclusions

The computer software markets in Eastern Europe are underdeveloped in comparison to the computer markets. Here are several reasons for that: Firstly there is the large dimension of software piracy which immensely reduces the value of the software market and, with it the turnovers of the software enterprises on these markets. A second reason is the still above average importance of individual software solutions, which are developed by domestic enterprises at low prices. This also keeps the expenditure on software low and therefore the value of the market remains small.
In the market segments for individual software projects of a small size and in the market segment for lowly standardised software products, domestic enterprises dominate the market. But it can be assumed that with a stabilisation of the economic and political situation, the importance of individual software will shift to standard software, because this will enable the standardisation of several application fields. With this, domestic enterprises will lose part of their competition advantage and international enterprises will enter the markets.
The S&T system is only used for the education of computer specialists. Participation in the development of new software products is very rare. With the high penetration of Eastern European software markets by western products, foreign S&T systems are used as suppliers of

[54] EITO (1994), p. 191.

modern software technology.

6. Estimation of the possibilities of a public policy

The presentation shows that the problems for eastern software enterprises are not the technical capabilities but the basic conditions of the software market. Competition is carried out on axes where a catching-up for newcomers will take several years and requires immense financial resources. On the competition for skilled and experienced personnel, the international enterprises have a large competition advantage because of their ability to pay high wages. Because those reasons are the result of the competition between software enterprises, a public policy would be not able to remove such hampering factors. Closing the domestic market will lead to a shortage of modern software technology and is therefore not an option which would help to improve the development of the domestic software industry. The knowledge transfer through the rising number of co-operations in each of the CEE and CIS countries show a economic solution to catching-up the knowledge advantage of western enterprises.

Possible starting points for a public policy are the named lacks of special parts of the infrastructure (chapter 4). Examples are the introduction of standardisation procedures and quality standards, the improvement of the telecommunication and patent protecting laws and their enforcement.[55] Another important starting point for public policy is the modernisation of education in terms of the impart of modern computer technology knowledge. As shown in the paper, the partial devaluation of human capital should be equalised by education measures.

Another important help for the software market, and with it the software industry, is economic and political stability, which would give customers planning security for the purchase of software. Instability in the legislation leads to the postponement of investment in computer software, because the adaptation cause immense costs or the software becomes completely useless. Because of the financial situation of the demanding enterprises, they are not willing to take the risk of their investment becoming sunk costs.

[55] Correa (1993b).

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